# Design a Pencil Holder

**Opening 10 to 20 minutes**

Have students go into Tinkercad. Have them explore and play with the system. Students learn a lot from each other and should share ideas.

Show students how to move objects back and forth then up and down. Have students learn how to group objects together.

Have students play with angles and rotating shapes. If they click on the curved arrows they can rotate the objects and even type in an angle amount. Show them how we take these angles from class to learn how to design objects.

**Designing the pencil holder (30 to 45 minutes)**

Depending on how students are doing with Tinkercad you may want to show them an example of how to create angles. Have a discussion with them on what is happening with each angle. They should see that lines can be rotated from any position not just from horizontal lines.

Show them how to rotate the cylinders to 20 degrees, 50 degrees and 85 degrees. They can see Tinkecad has a built in protractor for them to rotate shapes in different directions.

Show students how to take a cylinder and lay it flat 90 degrees. Students can take their measurements from the cylinder that is perpendicular to the build plate or from the angle of it laid flat. From there they can rotate the cylinder from 1 to 180 degrees.

Let them plan on three angles they would like to use. Then rotate three cylinders to the degrees they chose.

**Assessment Directions:**

Create a pencil holder with any shape. Create two, three, or four holes for pencils. Each hole has to be a different angle. You choose what angles you want to use. Next to each hole, put the number that indicates the angle of each opening.

For the diameter of your pencil at .4 mm to make sure the pencil will fit in the opening.

For example if your pencil is 7.2 mm make the diameter 7.6 mm.

If you do not have a 3D printer students can still design the pencil holder on Tinkercad.

If you are going to 3D print each holder have students export their files as and STL file. They can email you the files or upload them to TEAMs, Canvas or other system you are using. Try to keep each file under two hours for printing especially if you only have one 3D printer.